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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/790,953 | 03/02/2004 | Larry D. Sciler | 00100.02.0004 | 2164 |
| 29153 7590 07/02/2007 ADVANCED MICRO DEVICES, INC. C/O VEDDER PRICE KAUFMAN & KAMMHOLZ, P.C. 222 N.LASALLE STREET CHICAGO, IL 60601 | | | EXAMINER PAPPAS, PETER | |
| | | | ART UNIT 2628 | PAPER NUMBER |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|---|--------------------------------------|--|
| Office Action Summary | Application No. 10/790,953 | Applicant(s) SEILER ET AL. | |
| | Examiner Peter-Anthony Pappas | Art Unit 2628 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 02 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11, 13-15, 19 and 23-29 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 13-15, 19 and 23-29 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 October 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-11, 13-15, 19 and 23-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aila et al. (U.S. Pub. No. US 2005/0134588 A1) in view of Greene et al. (U.S. Patent No. 5, 579, 455).

3. In regard to claim 1 Aila et al. teaches a method and apparatus for image processing (Abstract; p. 2, ¶ 18). When images are processed, the frame buffer (including the color buffer and the z buffer) containing pixels of an image is typically divided into sets of pixels often called tiles. The tiles are often non-overlapping rectangular areas. For example, an image can be divided into non-overlapping 8x8 pixel regions (p. 3-4, ¶ 52).

To accelerate rendering of an image, the following extra information is often stored for each tile: the minimum of all depth values in the tile, Z-min, and the maximum of all depth values in the tile, Z-max (e.g., tile Z-min and tile Z-max). It is appreciated that for processing shadow information more efficiently, a new concept may be introduced. The perimeter of the tile and the minimum and maximum depth values define a tile volume. For a rectangular tile, for example, the tile volume is a 3D axis-aligned box in screen space, defined by the horizontal and vertical bounds of the

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rectangular tile together with the Z-min and Z-max values (p. 4, ¶ 53). It is appreciated that the tile volume need not necessarily be defined using the minimum and maximum depth values relating to a tile. A tile volume can be determined using the depth values relating to a tile in a different way. An alternative is, for example, the use of two planes: one plane in front of all depth values relating to a tile, and the other plane behind the depth values, for instance. The planes can be determined based on the depth values relating to the tile. The Z-min and Z-max values are, however, a very convenient way to define the tile volume, as this information is typically available (p. 4, ¶ 53).

To further enhance the performance of the graphics processor, it is possible to use a hierarchical stencil buffer or other hierarchical information store for shadow information (stencil code). If the result (stencil value) of the stencil test can be determined from a tile-specific entry of the hierarchical stencil buffer (containing a shadow mask), the per-pixel stencil buffer entries need not be accessed (p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4). It is implicitly taught that said entries can be accessed and thus it is noted that accessing said stencil buffer entries is considered to read on updating.

Aila et al. teaches determining whether to render a plurality of pixels within the tile (e.g., plurality of pixels belonging to respective objects that are within the boundary of a tile) based on depth information (p. 1, ¶ 5-6). However, Aila et al. fails to explicitly teach a hierarchical Z value range for which to compare said previously disclosed Z value range with. Greene et al. teaches a hierarchical Z-buffer scan-conversion algorithm that does well on both (a) quickly rejecting most of the hidden geometry in a mode, and (b) exploiting the spatial and temporal coherence of the images being

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generated. The method uses two hierarchical data structures, an object-space octree and an image-space Z-pyramid, in order to accelerate scan conversion. The two hierarchical data structures make it possible to reject hidden geometry (hierarchical Z value test fails) very rapidly while rendering visible geometry (hierarchical Z value test passes) with the speed of scan conversion (Abstract; col. 5, lines 66-67; col. 6, lines 1-8; col. 41-67; col. 18, lines 1-8). Greene et al. teaches that for each such Z-max element, the depth value which is written into that element is the farthest depth value in any of the Z-max elements which are covered by such Z-max element in the next finer granularity level. If the depth buffer 502 also includes Z-min elements, then the inner iteration also visits each of the Z-min elements in the current level. For each such Z-min element, the depth value which is written into that element is the nearest depth value in any of the Z-min elements which are covered by such Z-min element in the next finer granularity level (col. 14, lines 48-62). It is noted that a respective Z-min and Z-max (e.g., cache Z-min and cache Z-max) value for a given element, e.g., Fig. 5A element 512 (tile), is considered to represent a depth range.

It would have been obvious to one skilled in the art, at the time of the applicant's invention, to incorporate the teachings of Greene et al. into the method taught by Aila et al., because through such incorporation it would allow for quicker rejection of hidden geometry (Greene et al. – Abstract) thus improving the overall efficiency of said system.

4. In regard to claim 2: stencil test fails see Aila et al. – p. 7, ¶ 86; stencil test passes see Aila et al. – p. 7, ¶ 89; and hierarchical Z value test passes see Greene et al. – Abstract.

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5. In regard to claim 3 the rationale disclosed in the rejection of claim 2 is incorporated herein.

6. In regard to claim 4: stencil test fails see Aila et al. – p. 7, ¶ 86.

7. In regard to claim 5 see Greene et al. – col. 11, lines 4-12; col. 14, lines 48-67; col. 15, lines 1-6; col. 17, lines 24-40.

8. In regard to claim 6 Aila et al. teaches the use of a multiple-bit indicator for said stencil code (p. 9, ¶ 102), which specifies a relation of a plurality of stencil values in the tile relative to a background (e.g., no color) value (p. 9, ¶ 106). It is noted that the respective claim language is silent as to an actual value that defines said “background value” or “stencil value.”

9. In regard to claim 7 the rationale disclosed in the rejection of claim 1 is incorporated herein. Aila et al. teaches per-pixel processing (p. 5, ¶ 70). It is noted that each of said depth elements 512 are considered to represent respective pixel elements 204 (Greene et al. – Fig. 2, 5A) and therefore result, at least in part, in per-pixel processing.

10. In regard to claim 8 the rationale disclosed in the rejection of claim 1 is incorporated herein. Aila et al. teaches the use of a multiple-bit indicator for said stencil code (p. 9, ¶ 102), which specifies a relation of a plurality of stencil values in the tile relative to a background (e.g., no color) value (p. 9, ¶ 106). It is noted that the respective claim language is silent as to an actual value that defines said “background value” or “stencil value.”

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11. In regard to claim 9 Aila et al. teaches that if the Boolean boundary value (indicator) in the temporary tile classification buffer is TRUE for a tile, this needs to be rasterized using a finer resolution, for example, using per-pixel resolution. Otherwise the rasterization can be skipped, because the entire tile is either in shadow or lit (p. 7, ¶ 86).

12. In regard to claim 10 the rationale disclosed in the rejection of claim 7 is incorporated herein.

13. In regard to claim 11 the rationale disclosed in the rejection of claim 8 is incorporated herein (Aila et al. – p. 6, ¶ 83; p. 7, ¶ 88; Fig. 8).

14. In regard to claim 13 Greene et al. further teaches that if the Z-pyramid value is closer, we know the primitive is hidden in the quadrant. If we fail to prove that the primitive is hidden in one of the quadrants, we go to the next finer level of the pyramid for that quadrant and try again. Ultimately, we either prove that the entire polygon is hidden, or we recurse down to the finest level of the pyramid and find a pixel covered by the polygon that has a Z-value farther away than the nearest Z value in the polygon (col. 6, lines 28-36). The rationale and motivation disclosed in the rejection of claim 5 is incorporated herein.

15. In regard to claim 14 the rationale disclosed in the rejection of claim 8 is incorporated herein. It is noted that when respective pixels of a tile are considered lit, respective to a mask, and a hierarchical Z value test passes that a positive indication is considered to be set.

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16. In regard to claim 15 the rationale disclosed in the rejection of claims 3 and 4 are incorporated herein.

17. In regard to claim 23 the rationale disclosed in the rejection of claims 1 and 5 is incorporated herein. It is inherent that said tile, comprised of a plurality of pixels for display, has a location. It is noted a comparator (Aila et al. – Fig. 5, element 501) is considered coupled to a hierarchical Z buffer (Aila et al. – Fig. 5, element 521; Greene et al. – Fig. 1, element 104), stencil cache (Aila et al. – Fig. 5, element 523) and hierarchical Z buffer and stencil cache updater (Aila et al. – Fig. 5m, element 510). It is noted that the respective claim language is silent as to what exactly defines an “association” between a cache MinZ and cache MaxZ and the location of the tile. It is noted said association is considered the portion of space covered (e.g., Greene et al.) by a respective portion of said tile or portion of said tile. As previously disclosed Aila et al. teaches To further enhance the performance of the graphics processor, it is possible to use a hierarchical stencil buffer or other hierarchical information store for shadow information (stencil code). If the result (stencil value) of the stencil test can be determined from a tile-specific entry of the hierarchical stencil buffer (containing a shadow mask), the per-pixel stencil buffer entries need not be accessed (p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4).

18. In regard to claim 19 the rationale disclosed in the rejection of claim 23 is incorporated herein Aila et al. – p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4).

19. In regard to claim 24 the rationale disclosed in the rejection of claim 17 is incorporated herein.

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20. In regard to claim 25 the rationale disclosed in the rejection of claim 22 is incorporated herein.

21. In regard to claim 26 the rationale disclosed in the rejection of claim 23 is incorporated herein Aila et al. – p. 6, ¶ 83; p. 7, ¶ 88; Fig. 4).

22. In regard to claim 27 the rationale disclosed in the rejection of claims 11 and 13 is incorporated herein.

23. In regard to claim 28 the rationale disclosed in the rejection of claim 14 is incorporated herein.

24. In regard to claim 29 the rationale disclosed in the rejection of claim 1 is incorporated herein.

Response to Arguments

25. The prior 35 U.S.C. 101 rejection has been withdrawn upon further consideration.

26. In response to Applicant's remarks against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

In response to Applicant's remarks that Greene et al. always compares the Z-man value and Z-min value of the Z-pyramid to the same z-value of the primitive to is noted that Aila et al. was introduced to address the limitation of a tile having a respective Z-min and Z-man value, not Greene et al. Furthermore, in regard to Applicant's remark that Greene et al. "always" compares information a certain way it is

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noted that Greene et al. does not limit said comparison to being performed only one way – while Greene et al. may disclose a particular way of performing a comparison this is not the same as disclosing that only said particular way is performed. Applicant is directed to the respective rejections above which have been further clarified.

27. Applicant's remarks have been fully considered but are not deemed persuasive.

28. The Applicant is encouraged to setup an interview with the Examiner to discuss the instant application if the Applicant feels it would be beneficial.

Conclusion

29. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter-Anthony Pappas whose telephone number is 571-272-7646. The examiner can normally be reached on M-F 9:00am-5:30pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ulka Chauhan can be reached on 571-272-7782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Peter-Anthony Pappas
Examiner
Art Unit 2628

PP



Ulka J. Chauhan
Supervisory Patent Examiner